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ABSTRACT

The purpose of this paper is to introduce, describe, and compare three individual models for designing computer assisted instruction: the Instructional System Development Model (by Alessi and Trollip); Lessonware (by Grossley and Green); and Liflander's Model (by Liflander). The comparison between these models involves criteria such as: (1) At what level (lesson planning or course planning) can one use each of the models? (2) What learning theories lie behind the model? (3) What are the steps of planning in each model? (4) What is the structure of instruction? (5) Who will design and produce the program? and (6) When should the issue of quality control be considered? Several differences can be pointed out in the light of the aforementioned criteria, and it can be assumed that these differences will further be reflected in the programs. (11 references) (Author/GL)

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INSTRUCTIONAL MODELS FOR DESIGNING CAI

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ABSTRACT

The purpose of this paper is to introduce and describe three individual models for designing Computer Assisted Instruction. These models are: Instructional System Development Model (ISDM) by Alessi and Trollip (1985); Lessonware by Grossley and Green (1985) and Lifländer's Model by Lifländer (1989). The comparison between these models will involve the following criteria: 1. Where can one use these models? 2. What learning theories lie behind the models? 3. What are the steps of planning in each model? 4. What is the structure of instruction? 5. How to make your program? 6. Who will make it? 7. Quality control 8. Basic idea. Several differences between these models can be pointed out in the light of the aforementioned criteria, and it can be assumed that these differences will further be reflected in the programs.

INTRODUCTION

Instructional design is concerned with developing, improving, and applying methods of instruction. As a professional activity undertaken by teachers and instructional developers, it is the process of deciding which methods of instruction are best for bringing about desired changes in student knowledge and skills for a specific course content and a specific student population. The result of instructional design as a professional activity is an "architect's blueprint" for what the instruction should be like. This "blueprint" is a prescription as to which methods of instruction should be used when for a particular course content and students. (Reigeluth 1983, 7).

The result of an instructional design process, then, is not merely a blueprint from which the instructional developer produces an instructional product, it is also a statement about how instruction ought to occur in a given class of instructional situations. An instructional design, then, does not provide the instructional product itself, but it amounts to more than a mere sketch. It is a statement, a unique model as it were, by the designer about how instruction ought to occur. (Jonassen, 1988).

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Andrews and Goodson (1980) evaluated and compared forty instructional design models. While they found a good deal of disparity between models, there was a general agreement on the major components of the instructional development process. The instructional design process consists of three separate stages or phases: The first is the analysis phase, in which the instructional conditions and outcomes are identified and preliminary decisions about instructional methods are made; at the second stage, development or synthesis phase, decisions on methods are completed and enacted, through either the selection or production of instructional materials or sequences. The third and final stage is the evaluation phase, in which the methodological decisions are evaluated in the light of the conditions and outcomes, and where they may be accordingly amended. While instructional design models vary, most engage the designer in these three phases. The underlying learning theories behind these models seem to be behavioral. The following instructional models are from the late 80's so the reader can judge for him/herself what changes have taken place in the field.

Nowadays there are several instructional models for designing computer-assisted instruction. I selected three models for this comparison. The reason why I chose the following three models is that these models represent different approaches to designing courseware: Instructional Development Model (IDM) by Alessi and Trollip (1985); Lessonware by Grossley and Green (1985) and Lifländer's Model by Lifländer (1989).

Let me briefly introduce each model and then compare them emphasizing
the following criteria:
1. Where can one use these models?
2. What learning theories lie behind the models?
3. What are the steps of planning in each model?
4. What is the structure of instruction?
5. How to make your program?
6. Who will make it?
7. Quality control
8. Basic idea

INSTRUCTIONAL SYSTEM DESIGN MODEL

The Instructional System Design involves the following eight steps:
(Alessi & Trollip, 1985:279-309):

1. Defining the purpose

Defining the purpose means determining what is expected of the students to know or be able to do at the end of the

lesson.
It includes the following procedures:
- Stating the goal
- Producing a chart of student characteristics
- Stating the terminal goal and adding it to the chart of student characteristics

2. Collecting resource materials

Resource materials include every item or source of information essential to the instructional development effort. There are three kinds of resource materials: those relevant to the subject matter, those relevant to the instructional development and teaching process, and those relevant to the delivery system of the lesson, in this case, the programming language and computer intended for use.

3. Generating ideas for the lesson

To get a lot of ideas writers recommend to use brainstorming, which is a process in which a number of people work as a group to rapidly produce as many ideas as possible in a non-evaluative way. At this stage the emphasis is completely on quantity and not at all on quality.

4. Organizing ideas for the lesson

The outcome of brainstorming is a long list of ideas - at this stage the worst ideas are eliminated and then the remaining, worthwhile ideas are ordered and refined.

5. Producing the lesson's displays on paper

This includes storyboarding, which is the process of rewriting textual and pictorial displays so that they will fit within the display limitations of the computer.

6. Producing the flow charts

A flow chart is a series of diagrams that describe in detail what operations a computer should perform and in what order. The flow chart should include all the details of the sequence of lesson components, such as information presentations, questions, student interactions, and student choices.

7. Programming the lesson

Programming is the process of translating what is presented on paper into a series of instructions understandable to the computer. The program is produced directly from the flow chart and the storyboards.

8. Evaluating the quality and effectiveness of the lesson

At this last stage the lesson is evaluated with an eye toward how the lesson looks and how well it works. You will determine how the lesson looks by using it yourself and having others experienced in teaching and instructional design use it. This is called "lesson review". You will assess how well the lesson works by observing the results of students actually studying the lesson. This process includes both pilot testing and validation.

The ISDM is based on Instructional Systems Development (ISD), which is described in detail in a number of publications (O'Neil 1979a,b; Gagne & Briggs, 1979; Training and Doctrine Command, 1975). The ISD model is based on behavioral psychology, and its emphasis is on specifying behavioral objectives, analyzing learning tasks and activities, and teaching to specific levels of students' performance.

Especially Alessi & Trollip have used the ideas of Gagne, Wager, and Rojas (1981) for applying the ISD model to computer-based instruction. They describe nine important events in a lesson: gaining the student's attention, informing the student of the objectives, stimulating the student's prior knowledge, presenting the instructional stimuli, guiding the student, requiring student performance to strengthen and test learning, providing feedback about student performance, assessing student learning, and enhancing retention and transfer of learning.

However, there are some major differences between ISD and ISDM: the ISD model assumes that instructional development will be most effective when done in perspective of the entire curriculum, rather than just individual lessons. ISDM, on the other hand, is for planning usually individual lessons.

LESSONWARE (GRIMSTAD-MODEL)

This model evolved as direct criticism of that educational software which in the seventies and early eighties strongly used drill-and-practice programs and linear structure, where students did not have any freedom. The designers of this model have had one basic idea: the models and principles for planning excellent courseware are the same as for planning normal lessons. The authors' idea is to help teachers become lessonware designers.

This model consists of six steps:

1. First the whole instructional process and situation should be analyzed. The following questions should be asked:
WHO is the program for?
WHAT should be achieved?
WHY use the computer?

After this the essential components TIME, PLACE, and ROLE - the manuscript for the program - should be decided on. When will it take place, where will it happen, and what will be the role of the user in the program.

2. Planning the market. Running the program should be like shopping at a market. The possible actions are like stands or booths at a market. The student may visit these booths to

- do something
- fetch something
- change something
- investigate something
- maybe even learn something

3. Designing the key screen
This is a visualization of the open market place where the various activities open to the student are depicted.

4. Planning the state diagram

5. Planning the interaction

6. Documentation or programming

The basic idea behind Lessonware (Grimstad) model is that the learner is active and that different learners learn in different ways. Some like to employ instructional programs in one order and some in other. This model offers that possibility.

LIFLÄNDER'S MODEL

Lifländer's model is based on the cognitive learning theories to which the author ascribes the following characteristics:

- a learner is object-oriented, willing to learn and seek to understand himself and the outside world by constructing matter into intrinsic models and applying the knowledge acquired to direct actions

- in contrast to the behavioral view, the cognitive view emphasizes intrinsic (internal) sources of motivation, such as curiosity, interest in the task for its own sake, the satisfaction of learning, and a sense of accomplishment

- cognitive structures are the basic instruments of learning.

In other words the fruitfulness of learning can be attributed to the cognitive structures that a learner has been able to create in his mind rather than to the absolute amount of matter that has been learned.

Thus the pedagogical principles of this model could be summarized as follows:

- methods of instruction depend on the content

- the basis for motivation is supplied by cognitive dissonance

- the basis of orientation forms the core of instruction and learning

- the stages of a complete learning process involve motivation, orientation, interiorization and externalization, evaluation of what has been learned and assessment of achievement.

This model involves the following six stages:

1. The general syllabus

The subject matter is structured and defined at this initial stage. Then follows the determining of the zone of proximal development in the knowledge of the students.

2. The particulars of the syllabus

The detailed description of the learning process includes

the basis of orientation and phases of learning. Questions pertaining to, e.g., motivation, interiorization, evaluation, control belong at this stage.

3. The logical plan of the learning environment

The parts that comprise the learning environment and their interrelationships form the ground for the logical plan, which describes the stores of knowledge, records, simulations, games, and tools involved in the learning environment. Rules for operation can be seen as 'traffic regulations' which make the operating within the various parts of the learning environment safe and flexible.

4. Outline of the program

This process brings about a prototype which enables structural program testing before establishing the detailed program content.

5. The visual plan of the learning environment and plan of the interaction

The visual planning strives at giving the learning environment a visually attractive and interesting appearance which at the same time guides the user and supports the learning process devised at the first two stages. To this stage of the program design belongs the realization of the proposed inter-action for the program: the aim is to make the learning of an individual student as well as of the entire group as active and interactive as possible.

6. The production of the second proto type

The second proto type of the program enables the designer to have the students test a preliminary version of the program.

THE COMPARISON BETWEEN MODELS

To compare these models for designing computer-assisted instruction table 1 is presented.

Table 1. Comparing models of designing CAI

ISDM	Lessonware	Lifländer
1. Where one can use these models?		
Planning lessons	Planning small courses	Planning courses
2. What learning theories lie behind the models?		
Behavioral theories	Cognitive theories	Cognitive theories
3. What are the steps of planning in each model?		
Look earlier pages.		
4. The most important part of instruction		
Ideas of content	Finding the basic rules	Orientation, principles of the content
5. How to make your program?		
No restrictions	No restrictions	No restrictions
6. Who will make and design the program?		
Teachers and programmers	Teachers and programmers	Teachers and programmers
7. Quality control		
At the end of process	All the time	All the time
8. Basic idea		
Brainstorming of ideas Content of the program	The entire learning process The keyscreen and all learning options accessible all the time	The orientation of the basic principles of the task and the problem. The entire learning process

CONCLUSION

These models represent only a selection of the models for designing computer-assisted instruction which are available. However, the progress of planning models shows that there are serious attempts to develop computer-assisted instruction in accordance with modern ideas about learning and instruction: there the student is seen as an active learner. It is interesting to note that this progress goes hand in hand with the available advances in technology: to create programs which support modern ideas of learning and instruction we need, in many cases, technology, which was not available, say, 10 years ago.

Of course it has to be said that having such models for designing computer-assisted instruction that have their basis in a cognitive approach to learning does not necessarily generate a large-scale production of corresponding educational programs. There are still many barriers to break. Such models for designing computer-assisted instruction exist which can make the difference in that they provide sufficient qualitative improvements to meet the requirements which have been set for a good instruction. Now we need people who observe these models and make them alive. The next step will be the comparison of programs which have been designed using the above mentioned models, and probably after that one could say which model is more suitable in one situation and which in another.

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